1.0 Executive Summary

1.1 Background

This Engineering Report outlines improvements to the combined sewer system serving the Windermere Basin that are necessary to reduce Combined Sewer Overflows (CSOs).

The 854-acre Windermere Basin, shown in Figure 1-1, is located in northeast Seattle near Magnuson Park on Lake Washington and encompasses four basins: Basins 12, 13, 14, and 15.

The Windermere Basin was originally constructed as a combined sewer system, meaning that both sanitary sewage and stormwater runoff are conveyed in the same pipe. The sewer system has been modified over time. Some portions of the Windermere Basin now have fully separated sewer systems, meaning that sanitary sewage (sewage) and stormwater are collected and conveyed in separate pipe systems. Other portions of the Windermere Basin now have partially separated sewer systems, meaning that stormwater from roof drains enters the sanitary sewer system while stormwater from roadways enters a separated drainage system.

For combined and partially separated systems, under wet weather conditions, flows are a combination of sewage and stormwater. As long as the flow volumes are within the capacity of the sewer system, all the flows are conveyed to the wastewater treatment plant. However, if the flow volumes exceed the capacity of the sewer system, the excess volume of sewage and stormwater is discharged into receiving water bodies through outfalls. This is called a Combined Sewer Overflow (CSO). The Windermere Basin overflows into Lake Washington as shown in Figure 1-1.

CSOs should be limited to an average of no more than one untreated discharge per year per outfall, per the following:

- **Revised Code of Washington (RCW):**
  - **RCW 90.48.480:** This law requires **"**the greatest reasonable reduction of combined sewer overflows."
- **Washington Administrative Code (WAC):**
  - **WAC 173-245-020 (22):** "'The greatest reasonable reduction' means control of each CSO in such a way that an average of one untreated discharge may occur per year."

The CSO status of each basin is as follows:

- Basin 12 - Meets an average of no more than one untreated discharge per year
- Basin 13 - Does not meet an average of no more than one untreated discharge per year. Requires improvements, which are the focus of this Engineering Report
- Basin 14 - Meets an average of no more than one untreated discharge per year
- Basin 15 - Is expected to meet the average of no more than one untreated discharge per year with a retrofit implemented in March 2010

A key design parameter for any basin that does not meet an average of no more than one untreated discharge per year per outfall is the volume of flow that must be controlled (the CSO control volume).

The CSO control volume is defined in terms of the volume of excess combined sewage that must be captured or intercepted to meet an average of no more than one untreated discharge per year per outfall. Based on flow monitoring and modeling, the CSO control volume for Basin 13 was estimated to be 1.9 million gallons (MG). For more information about the modeling and monitoring effort, please refer to Chapter 6 of this report. When solutions to control the 1.9 MG are incorporated into the basin model, and the model is run using 31 years of rainfall data, the results indicate that Basin 13 would meet the average of no more than one untreated discharge per year per outfall.

The required CSO storage volumes for the various alternatives in this report are not the same as the CSO control volume. They vary because the storage volume for each of the alternatives is dependent on additional factors including: 1) system hydraulics, 2) storage location, 3) control system, and 4) timing of the release of stored volumes to avoid impacts to downstream facilities.

1.2 CSO Reduction Alternatives Development

A variety of alternatives to address the CSO issue in the Windermere Basin were developed and evaluated. The process used to develop and evaluate the alternatives included the following nine major steps:

- **Step 1 – Develop Generic Options:** Identify CSO reduction options, which are techniques or technologies that could be implemented to reduce CSOs.
- **Step 2 – Screen Options for Fatal Flaws:** Screen the initial list of options for fatal flaws to reduce the number of options into a manageable set of likely options for further analysis.
- **Step 3 – Customize Options for Windermere Basin:** Customize the surviving options for the Windermere Basin.
- **Step 4 – Develop Initial Alternatives:** Use the customized options to develop alternatives, which are complete solutions to meet the necessary 1.9 MG CSO control volume criteria.
- **Step 5 – Refine Alternatives and Eliminate Fatal Flaws:** Refine the alternatives further and eliminate any alternatives with fatal flaws.
- **Step 6 – Perform Triple Bottom Line Analysis to Determine Top Three Alternatives:** Apply Triple Bottom Line analysis to the surviving alternatives to identify the top three alternatives for further analysis (See Section 1.3 for definition of Triple Bottom Line).
- **Step 7 – Refine Top Three Alternatives:** Apply additional engineering, modeling, and cost estimating to the top three alternatives.
- **Step 8 – Perform Triple Bottom Line Analysis to Determine Recommended Alternative:** Apply a second round of Triple Bottom Line analysis to the top three alternatives, using refined data, to determine the recommended alternative.
- **Step 9 – Refine Recommended Alternative:** Apply additional engineering, modeling, and cost estimating to the recommended alternative.

A total of 18 alternatives were developed and considered to reduce CSOs in Basin 13. Table 1-1 lists the 18 alternatives and their final status.

All alternatives include a system retrofit that will optimize the use of the existing system storage (CSO 22 and 22A near Windermere Park) by removing two HydroBrakes and replacing them with a single, automatically controlled gate. This gate will send flows into storage at times when it is most beneficial to the system, thereby reducing CSOs. This retrofit is planned to be completed in 2010-2011.

Eight alternatives were eliminated in Step 5 for various reasons which are documented in Table 1-1. Ten alternatives underwent the Triple Bottom Line analysis in Step 6. Three alternatives were moved forward from Step 6. Those alternatives were the Center for Spiritual Living, Burke-Gilman, and Magnuson Park off-line storage alternatives. Those three alternatives underwent refinement in Step 7 and another round of Triple Bottom Line analysis in Step 8. Alternative 1, the Magnuson Park Parcel 9 alternative, emerged as the recommended alternative based on the Triple Bottom Line analysis.

Table 1-1. Final Alternatives Status

ALTERNATIVE	FINAL STATUS
Alternative 1 Off-line Storage at Magnuson Park Parcel 9 [1]	• Identified as recommended alternative
Alternative 2 Off-line Storage at Windermere Park	• Eliminated in Step 6 based on Triple Bottom Line analysis
Alternative 3 Off-line Storage at Sand Point Elementary School	• Eliminated in Step 6 based on Triple Bottom Line analysis • Would have been eliminated in Step 5 due to critical risk of property restrictions if the risk had been identified earlier
Alternative 4 Off-line Storage at Federal Archives	• Eliminated in Step 5 due to property restrictions
Alternative 5 Off-line Storage at Center for Spiritual Living	• Eliminated in Step 8 based on Triple Bottom Line analysis
Alternative 6 Off-line Storage in Tunnel	• Eliminated in Step 6 based on Triple Bottom Line analysis
Alternative 7 Distributed In-line Storage	• Eliminated in Step 5 due to hydraulic limitations
Alternative 8 Distributed Off-line Storage	• Eliminated in Step 5 due to hydraulic limitations
Alternative 9 Off-line Storage at Sand Point Elementary and Increase CSO Control Structure 23	• Eliminated in Step 6 based on Triple Bottom Line analysis • Would have been eliminated in Step 5 due to critical risk of property restrictions if the risk had been identified earlier
Alternative 10 Storage near Belvoir Pump Station with Pump Station	• Eliminated in Step 5 due to hydraulic limitations
Alternative 11 Source Control with Green Stormwater Infrastructure Combined with Off-line Storage	• Eliminated in Step 5 due to hydraulic limitations
Alternative 12 Increased Conveyance Capacity with Off-line Storage at UW Housing and Pump Station at Windermere Park	• Eliminated in Step 5 based on cost-effectiveness compared to similar alternative

ALTERNATIVE	FINAL STATUS
Alternative 13 Infiltration Reduction and Off-line Storage at Sand Point Elementary School	• Eliminated in Step 6 based on Triple Bottom Line analysis • Would have been eliminated in Step 5 due to critical risk of property restrictions if the risk had been identified earlier
Alternative 14 Off-line Storage in Burke-Gilman Trail	• Eliminated in Step 8 based on Triple Bottom Line analysis
Alternative 15 Increased Conveyance Capacity with Off-line Storage at UW Housing and Pump Station at Center for Spiritual Living	• Eliminated in Step 6 based on Triple Bottom Line analysis
Alternative 16 Increased Conveyance Capacity and In-line Storage in Burke-Gilman Trail	• Eliminated in Step 6 based on Triple Bottom Line analysis
Alternative 17 Off-line Storage at Burke-Gilman Playground	• Eliminated in Step 5 due to property restrictions
Alternative 18 Off-line Storage at Villa Sacred Heart Academy	• Eliminated in Step 5 based on topography and constructability issues

1. Three locations were considered at Magnuson Park. The first two locations were in the southwest corner of Magnuson Park at the intersection of Sand Point Way NE and NE 65th Street. However, property and operational restrictions were identified that resulted in those locations being eliminated for consideration and the third location ("Parcel 9") became the preferred site for the Magnuson Park alternative.

1.3 Triple Bottom Line Analysis

The evaluation of the ten alternatives not already eliminated by Step 5 was done using a Triple Bottom Line analysis in conformance with SPU's asset management program. The goal of the asset management program is to meet agreed-upon customer and environmental service levels while minimizing life cycle costs. Principles of the asset management program are that SPU is customer centric; considers life cycle costs, benefits, and risks; makes decisions based on Triple Bottom Line analysis; and operates with transparency.

Triple Bottom Line analysis is an economic analysis technique that evaluates the benefits, costs and risks of three areas: 1) financial, 2) social, and 3) environmental. This technique provides an analytical and modeling framework to find the most economical balance between capital investments and operation and maintenance expenditures so as to minimize the life-cycle costs of any capital asset, all while incorporating social and environmental aspects.

The top three alternatives were Alternative 1 Off-line Storage at Magnuson Park Parcel 9, Alternative 5 Off-line Storage at Center for Spiritual Living, and Alternative 14 Off-line Storage in Burke-Gilman Trail.

The Magnuson Park Parcel 9 Alternative was identified as the recommended alternative, based on the Triple Bottom Line analysis, for the following reasons:

- Lower life-cycle cost compared to the Burke-Gilman Trail Alternative.
- Higher social and environmental value compared to the other two alternatives.
- Large, unused space that would not require the temporary dislocation of current users, unlike the other two alternatives.

- Would result in the removal of fewer healthy mature trees, compared to the Burke-Gilman Trail Alternative. The Burke-Gilman Trail Alternative would require the removal of a grove of mature trees that provide a buffer between the trail and the street.
- Would facilitate easier routine and emergency maintenance, compared to the Burke-Gilman Trail Alternative, which would require shutdown of the trail for maintenance.
- Property is owned by the City of Seattle, whereas the Center for Spiritual Living Alternative site is privately owned, and the current owner was not interested in locating the storage tank on their property.

1.4 Recommended Alternative Off-line Storage at Magnuson Park Parcel 9

The Magnuson Park Parcel 9 Alternative consists of an approximately 2.05 MG underground CSO storage tank. The 2.05 MG storage volume is based on flow modeling that predicts a reduction of overflows at NPDES CSO Outfall 13 (see Figure 1-2) to an average of no more than one untreated discharge per year. As discussed in Section 1.1, the storage volume is different than the 1.9 MG control volume.

Three locations were considered at Magnuson Park. The first two locations were in the southwest corner of Magnuson Park at the intersection of Sand Point Way NE and NE 65th Street. However, property and operational restrictions were identified that resulted in those locations being eliminated for consideration and the third location ("Parcel 9") became the preferred site for the Magnuson Park alternative. The storage tank would be located on property just south of Magnuson Park on NE 65th Street. The property is owned by the City of Seattle Office of Housing and is leased to Solid Ground Washington a non-profit social services organization. The City refers to the location as "Parcel 9."

The main components of this alternative include the following:

- 2.05 MG underground CSO storage tank at Magnuson Park
- A buried facilities vault for odor control, mechanical and electrical equipment and control valves
- A motor-operated gate at CSO Control Structure 23 that replaces the existing HydroBrake
- Approximate 2,250-foot-long gravity diversion sewer with shut-off valves and parallel discharge force main located within NE 65th Street and Sand Point Way NE

The primary project area is the location of the storage tank in Magnuson Park, however the complete project area also includes areas along Sand Point Way NE and NE 65th Street for the gravity diversion sewer and force main.

Table 1-2 summarizes the estimates for total project costs for the recommended alternative.

Table 1-2. Estimated Total Project Costs

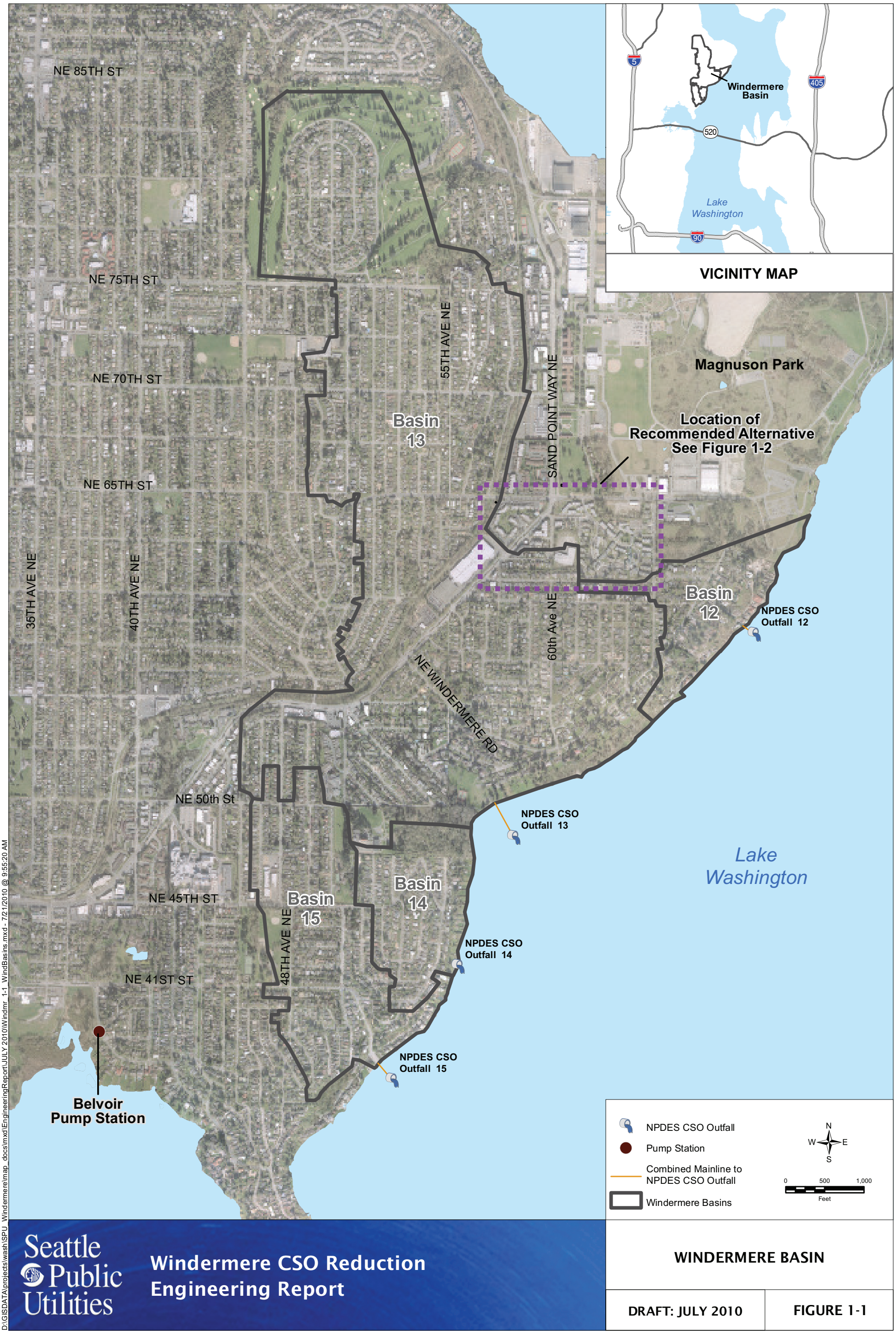
DESCRIPTION	TOTAL COST
Project Management	$3,825,000
Project Development	$1,750,000
Preliminary Engineering	$6,750,000
Property Acquisition	$606,000
Permitting	$1,440,000
Design	$4,131,000
Construction Contract[1]	$30,719,000
Construction Management	$3,363,000
Closeout	$536,000
TOTAL	**$53,120,000**

[1] The cost estimate class for this stage of the project (AACE Class 4) allows for a -30 percent to +50 percent contingency on the base construction cost and sales tax at the high end of the cost estimate range. The construction contract number in this table uses a +30 percent contingency.

The conceptual-level construction schedule for building the CSO storage facility at the Magnuson Park Parcel 9 site is provided in Table 1-3. The dates are approximate and the schedule will be fine tuned as the project progresses. The schedule is based on a GC/CM (general contractor / construction management) approach to construction contracting.

Table 1-3. Preliminary Construction Schedule

PHASE	APPROXIMATE DATE
Final Plans & Specifications	1st quarter 2012
Construction start (Mobilization & Site Preparation)	1st quarter 2012
Substantial completion	2nd quarter 2014
Contract closeout	2nd quarter 2015


NE 85TH ST
NE 75TH ST
NE 70TH ST
NE 65TH ST
NE 50th St
NE 45TH ST
NE 41ST ST
35TH AVE NE
40TH AVE NE
55TH AVE NE
SAND POINT WAY NE
60th Ave NE
48TH AVE NE
NE WINDERMERE RD
Basin 13
Basin 12
Basin 14
Basin 15
Magnuson Park
Location of Recommended Alternative See Figure 1-2
NPDES CSO Outfall 12
NPDES CSO Outfall 13
NPDES CSO Outfall 14
NPDES CSO Outfall 15
Belvoir Pump Station
Lake Washington
Windermere Basin
5
405
520
90
VICINITY MAP
NPDES CSO Outfall
Pump Station
Combined Mainline to NPDES CSO Outfall
Windermere Basins
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Seattle Public Utilities
Windermere CSO Reduction Engineering Report
WINDERMERE BASIN
DRAFT: JULY 2010
FIGURE 1-1
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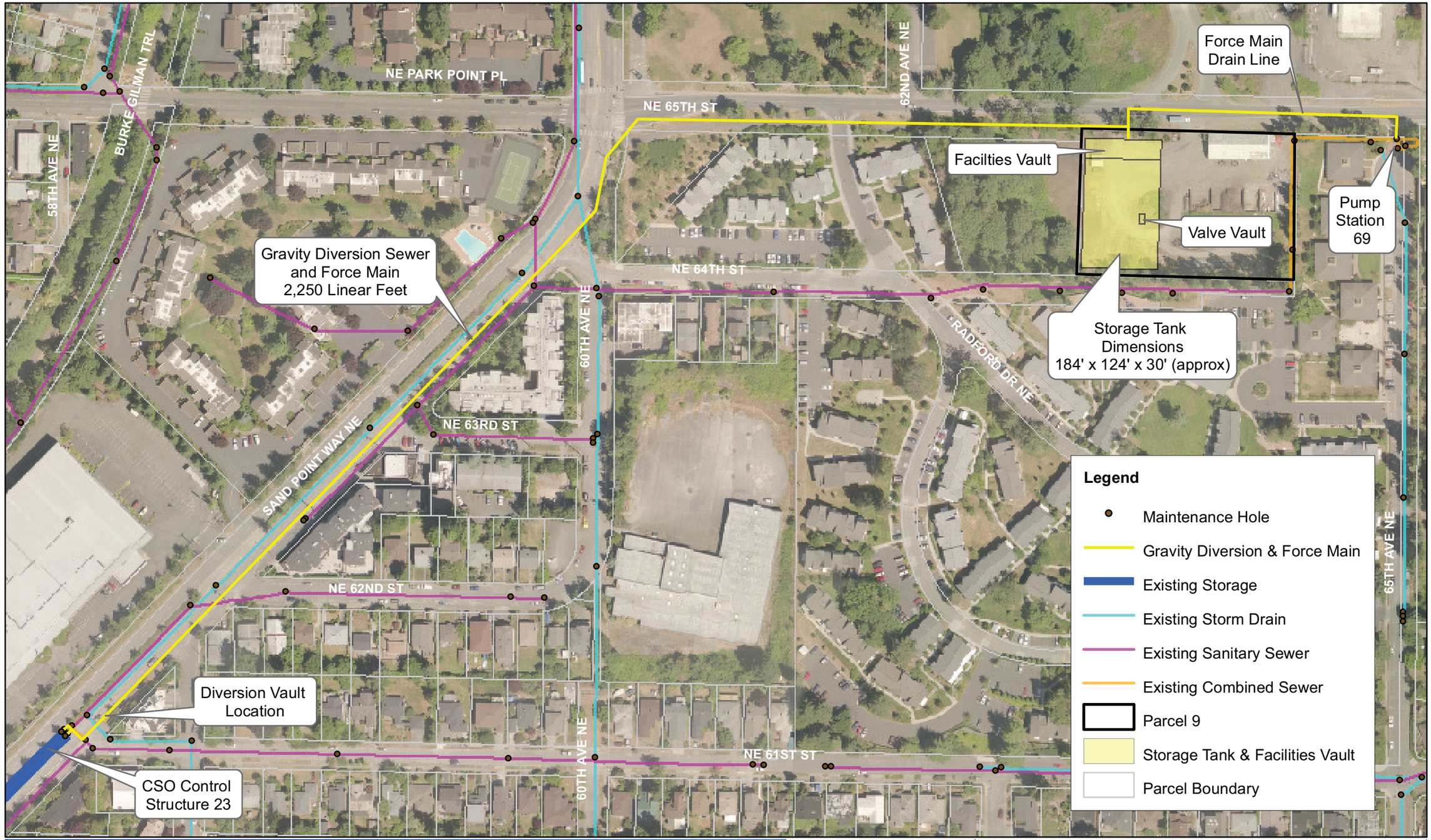

Seattle Public Utilities

Windermere CSO Reduction Project
Engineering Report

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MAGNUSON PARK
PARCEL 9 ALTERNATIVE

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FIGURE 1-2